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ABORIGINAL AMERICAN ZOÖTECHNY

By OTIS TUFTON MASON

INTRODUCTION

PLACE OF ZOÖTECHNY IN A GENERAL SCHEME OF ACTIVITIES

The activities of man are divided into classes according to the department of nature in which they take place; to wit, exploitation of the forces of nature; the invention of mechanical devices for the domestication and use of these forces; the activities associated with the mineral kingdom, with the vegetal kingdom, with the animal kingdom, and with the human species. All industries associated with the animal kingdom are included in the general term zoötechny.

AMERICA'S PLACE IN ZOÖTECHNY

In all times and places the human species has been intimately associated with animal life to obtain food, clothing, shelter, and material for its arts. The American continent, before its discovery by the whites, was inhabited by a subdivision of mankind that occupied the lower and middle stages of human culture. In a general way, therefore, the study of zoötechny in this area will make plain the same kinds of activities as those which existed in other parts of the world from the beginning of human life on the globe. Aboriginal American zoötechny embraces every phase of Indian life growing out of the connection between man and the beasts of the western hemisphere in precolumbian times.

A thorough prosecution of this study is very much embarrassed by intrusions from the eastern hemisphere in historic times. Omitting all inquiries with reference to the origin of arts on this continent, there is no doubt that in every part of America, from the very earliest intrusion, the activities of the aborigines were changed and accultured from abroad. These influences on the Atlantic side were by Scandinavians; by English and French in Canada and the United States; and by the French, Spanish, and Portuguese in Middle and South America. On the western side the Russians, in the northern parts, brought not only the arts of Siberia and of the uncultured elements in Russian population; but, having been engaged in traffic throughout the Pacific ocean and having used the Sandwich islands as headquarters for much of their trade, abundant evidences exist of their contact, not only with the Eskimo, but with the Indians of southeastern Alaska. It shows itself in the Polynesian motives on Eskimo carvings and in tools which are evidently of Polynesian origin.

In western United States and throughout the entire Pacific area of Latin America there was constant contact, through the Mexicans, with the colonies of Spain in southwestern Asia and the contiguous islands. Furthermore, when it is remembered that in southern Spain there was an agglomeration of Phenician, Jewish, Arabian, Egyptian, and north African cultures, and that great numbers of Africans were early brought to this continent and mingled with the Indian populations, there is no wonder that the student of technology is constantly at his wits' end to know whether like inventions have been independently worked out, or whether they had a common source. There is no space in this brief paper to discuss this subject, but it is capable of indefinite expansion.

ZOÖTECHNIC PROVINCES

The industries of the American aborigines, in connection with the animal life of the hemisphere, may be divided into zoötechnic provinces.

In a paper published in the Smithsonian Report for 1895, under the title *Influence of Environment upon Human Activities and Arts*, an attempt is made to separate North America and South America into eighteen environmental areas with reference to all of the activities of industrial life. It will interest the reader to note the close connection between zoölogic areas and Indian stock areas. Indeed, Merriam proposes to include the tribes of men among the animal species predominant in his groupings. For instance, his list for the Arctic is as follows:

A.—Exclusively Arctic

Eskimo	*Homo*
Polar bear	*Thalarctos maritimus*
Barren ground bear	*Ursus richardsoni*
Muskox	*Ovibos moschatus*
Barren ground caribou	*Rangifer groenlandicus*
Arctic fox	*Vulpes lagopus*
Arctic hare	*Lepus glacialis*
Lemming	*Myodes obensis*
Lemming	*Cuniculus torquatus*
Arctic red-back mouse	*Evotomys rutilus*
Parry's spermophile	*Spermophilus empetra*

B.—Common to Arctic and Hudsonian

Wolverine	*Gulo luscus*
Gray wolf	*Canis griseus*
Ermine	*Putorius erminea*

It is not difficult to understand how this came about. Where an animal becomes so necessary to a people that all their activities are in reference to it, they will not wander far away from it; their thoughts will be suggested by it, and even their totems refer to it. If by some stress a tribe of another stock be driven into the area, they drop their old habits and become assimilated to the region.

A good illustration of this is furnished by a story once told by Major Powell, concerning an Indian guide whom he had employed in the mountain regions of northern California. They tramped together for a long time until at last the Indian sat down and refused to go farther. When the distinguished traveler inquired the reason, it was a long while before he got an answer; but finally the Indian said that he had not seen a rabbit for some hours. The Major had the sagacity to tell the Indian that he also had noticed the absence of the rabbit and proposed to go back, which the guide was only too ready to do.

Jacob Bægert said of the Indians on the California peninsula: "All of these petty nations or tribes have their own countries, of which they are more enamored than other people of theirs."

From the point of view here assumed these areas may be characterized as follows:

Zoötechnic Areas	Peoples	Predominant Animals
1. Arctic	Eskimo	White bear, muskox, lemming, marine mammals.
2. Canadian	Athapascan	Reindeer, fox, wolf, and other fur-bearing animals.
3. Atlantic slope	Algonquian	Beaver, bear, deer, fox, turkey, fish, mollusks.
4. Louisiana or Gulf	Muskhogean	Bear, deer, migratory birds, and gulf-fishes.
5. Plains of the Great West	Siouan	Buffalo, bear, deer, and prairie dog.
6. Southeastern Alaska	Haida-Tlinkit	Otter, pelagic fish, and aquatic mammals.
7. Columbian region	Salish-Chinook	Mixed aquatic and land animals, wild goat and sheep.
8. Interior basin	Shoshonean	Elk, antelope, rabbit, wolf.
9. Californian region	Very mixed stocks	Inland fish, elk, rabbit.
10. Pueblo region	Tanoan-Tewan and Sonoran	Coyote, mountain lion, and rabbit.
11. Middle America	Aztec-Maya	Lizard (iguana), subtropical animals, and peccary.
12. Antillean region	Arawak-Carib	Rodents, tropical birds, manatee, marine animals, turtles.
13. Cordilleran region	Chibcha-Kechua	Llama, chinchilla.
14. Upper Amazonian region	Jivaro, Peba, Puno, etc.	Birds of beautiful plumage, monkeys, river products.
15. Eastern Brazilian region	Tupi-Guarani, Tapuya	Monkeys, agouti, peccary, tapir, sloth, turtles, fish, mollusks.
16. Mato Grosso and southward	Mixed peoples of Brazilian and Andean types	Monkeys, agouti, peccary, tapir, inland fish, mollusks.
17. Argentina-Patagonian region	Chaco, Pampean, and Patagonian stocks	Vicuña, rhea or American ostrich.
18. Fuegian region	Aliculuf, Ona, and Yahgan	Mollusks and other marine products, formerly seal.

The region gives character to the activity, not only by the species of animals predominating there, but by the abundance or scarcity the year round or at certain seasons.

Coville[1] says: "To a traveler passing across our southwestern desert region it is a matter of great wonder how the Indians of that country contrive to subsist. The question is not what furnishes the best food, but what will furnish us any food."

On the upper Ucayale the savage has not been able to compete with the terrible forces of nature. Animal life is not plentiful, fish are not abundant in the streams, and the power of the native to penetrate the forests is limited owing to the tangled mass of undergrowth.[2]

The same story, only in a different element, would be told by the Fuegians, who, having exhausted the food supply of one cove or inlet, are compelled to go across an intervening bluff to reach the next source of food. For this purpose they have invented a canoe of bark which can be taken to pieces and transported over the mountain on the backs of men and put together again at the next inlet. On the contrary, there were areas in Arctic America, in Bering sea, on the Pacific coast, in the rivers of southern United States, in the Antilles, and on the Amazon, where food was so abundant at certain seasons that the natives were content to live "from hand to mouth." In such cases the great abundance would be an impediment to the inventive faculty, and in the procuring of such supplies the natives did not practice their greatest ingenuity.

DIVISIONS OF ZOÖTECHNY

The study of zoötechny will include the following chapters: I, American Indian zoölogy, or ethnozoölogy in America. II, Exploitive zoötechny—the activities associated with the capture and domestication of animals. III, Elaborative zoötechny—the activities practiced on the animal after capture. IV, Ultimate products of zoötechny and their relation to human happiness. V, Social organizations and coöperations. VI, The progress of knowledge in zoötechny, including the growth of language. VII, Religion and the animal kingdom.

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[1] *American Anthropologist*, vol. V, p. 351.

[2] Church, in *Proc. Roy. Geog. Soc.*, London, 1892, vol. XIV, p. 397.

I. AMERICAN INDIAN ZOÖLOGY

In one form or another the entire fauna of each region directly or indirectly enters into the life and thought of its peoples. There are desolate places where it requires the coöperation of all the animals to keep the population alive; also there are idiosyncrasies of men in relation to animals that have no ethnic significance. It is not designed here to make such a wide inclusion. As there are creatures innumerable which are not amenable to domestication, there are also hosts of them which do not even come into general notice. It is not here concerned with what this or that man ate or wore, but in each tribe with what they all busied themselves habitually. The naturalist, on this count, would enumerate, for each area, a long list of invertebrate creatures, of fishes, reptiles, birds, and mammals; but the Indian would not go above a hundred species, and could count his chosen friends on his fingers and toes. It is this favored few, everywhere, that contribute the material for the study of zoötechny. If possible, the zoölogy of the region as it is recounted by the savage should be worked out. Finally, there are certain animals, such as foxes, wolves, and bears in North America, and the puma in South America, which wander over entire continents as freely as man himself.

The Smithsonian Report for 1887 (pp. 452–454) gives an extensive list of the animals which enter into the industrial life of the Eskimo in Greenland. The Labrador tribes subsist on the reindeer, porcupine, goose, duck, ptarmigan, and hare; they procure fur from the marten, mink, beaver, muskrat, lynx, wolverine, wolf, fox, and bear (Turner).

At Point Barrow, Murdoch studied the animals which were the natural resources of Eskimo art in that region.[1] Bishop

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[1] *Ninth Ann. Rep. Bureau of Ethnology*, 1887–88, p. 55.

Bompas details the animals hunted by the inland tribes of Alaska and Arctic America.[1] A list of the food fishes of all the Alaskan Eskimo is given by Bean,[2] who says that every grown male native of Alaska is a fisherman. "Women and children help to increase the stores for winter, taking away great strings of salmon caught in the seines." The standard food fishes of the northern Pacific coast are salmon, herring, candle-fish, cod, and halibut; but these are supplemented for various purposes by a number of other animals.

In northwestern Canada, according to Whitney,[3] the Chipewaian have abundance of fish in the rivers; on the river banks, fisher, otter, mink, beaver, and muskrat; and in the forest, moose, caribou, bear, mink, fox, wolf, wolverine, marten, ermine, and rabbit; in the spring and autumn, migratory birds. George Gibbs[4] furnishes a list of the foods of the people of British Columbia, Vancouver island, and the Straits of Fuca. They do not differ materially from those farther north. Lucien Carr[5] has gathered accounts of game formerly taken by the tribes in Virginia and other southern states. This paper is an exhaustive resume of the bibliography relating to this subject. An excellent account of the animal life with which the Indians of Guiana and Venezuela were familiar is given by Everard F. im Thurn.[6]

The Yahgans of Tierra del Fuego hunt and fish; their animals are principally sea birds, otter, seal, and whales, besides a number of marine invertebrates (*Hyades*). Old voyagers speak of the abundance of seal and other sea mammals about Tierra del Fuego. The destruction of this animal food supply is post-columbian.

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[1] *Northern Lights*, London, p. 182.

[2] *The Fisheries and Fishery Industries of the United States*, Washington, 1887, pp. 101–102.

[3] *Harper's Magazine*, 1896, p. 360.

[4] *Contributions to North American Ethnology*, vol. I, p. 195.

[5] *Proceedings of the American Antiquarian Society*, vol. x, p. 184.

[6] *Among the Indians of Guiana*, London, 1883.

A careful study of this wholesale destruction of animal life goes far to explain how, with such meager apparatus of stone and wood and animal integuments, the savage could live; it further explains the later migrations of tribes to regions far away from their priscan homes. Like the lonesome guide of Major Powell, they missed their totemic friends and were driven to seek new ones.

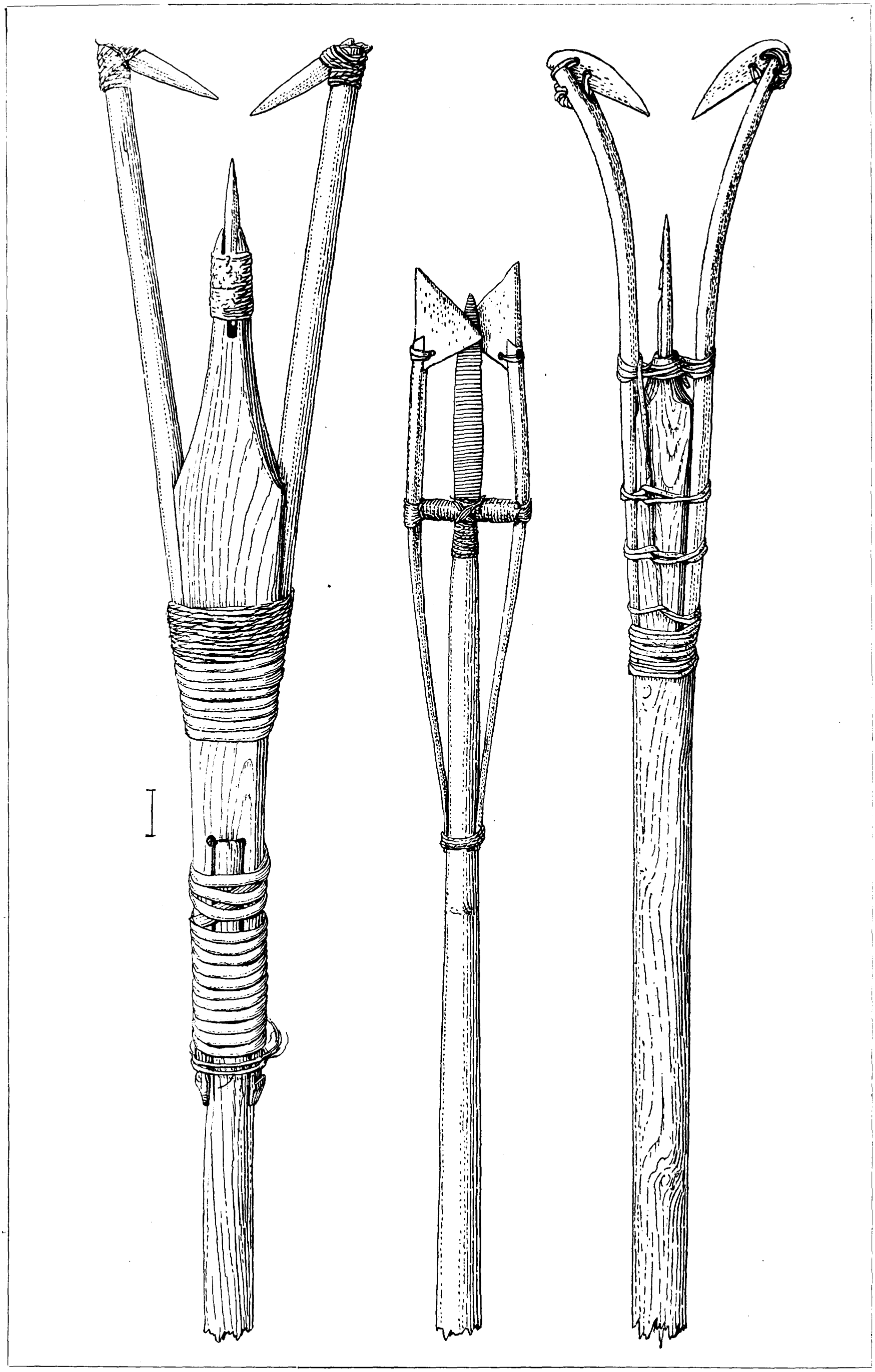
II. THE CAPTURE OF ANIMALS

METHODS OF CAPTURE

The taking of animals from the hand of nature concerns itself with the atmosphere, the earth, and the waters, and the occupations associated therewith go by the general names birding or fowling, hunting, and fishing. These terms are not to be interpreted here except in the most general way. So little is done by savage people in the way of gathering animals from the air, that this chapter will be concerned largely with terrestrial and aquatic capture. The industries associated with capture begin with very simple methods and end with most complicated practices, and in a general way they may be set forth in the following order:—

1. Gathering or taking with the hand without implements.
2. Gathering with devices.
3. Striking, stunning, bruising.
4. Slashing with edged weapons.
5. Piercing with a great variety of implements.
6. Taking in traps and blinds.
7. By means of dogs or other hunting animals.
8. With fire.
9. By means of drugs.
10. The whole class of accessories to the hunter.
11. Domestication, the raising of animals in captivity.

The progress of invention, which is the main idea here involved, has proceeded in every class from what Professor Rouleaux calls naturism to manganism, from simplicity to complexity, from individual effort to coöperation, from hand-worked devices to those mechanically and automatically worked, and frequently



LEISTERS: COMBINATION STRUCTURE FOR GRASPING, PIERCING, AND RETRIEVING, FROM ALASKA

National Museum, Nos. 23,518, 29,864, and 49,051. Collected by Swan, Turner, and Nelson results in the compounding of several mechanisms or methods into one. (See plate I.)

THE FIRST METHOD OF CAPTURE

In all the areas mentioned the simplest and easiest method of obtaining animals and animal products is with the hand. In all of them there is some form of animal life or production which the Indian might have by simply reaching forth to take it in the same way that he gathers the fruits of plants, frequently eating forthwith what he has obtained. Indeed, many of these methods of harvesting animal life have been prolonged into civilization. We are accustomed every day to eat or to utilize, in some way, molluscan life, to hunt cochineal, bird eggs, turtle eggs, and other materials, which have been procured by simply taking them up. From this most simple operation, which is practiced in common with our friends the animals, the taking by hand passes through a series of operations which become more and more difficult and require greater and greater skill. All parts of the body are laid under tribute. The man cannot fly, but he must learn to run, climb, swim, dive, go stealthily, becoming the apt pupil of the natural pedagogs, the animals.

These operations may be arranged in some such series as the following:

1. Taking up and using on the spot.
2. Gathering and carrying away to consume.
3. Selecting and differentiating for use.
4. Pursuing and capturing.
5. Climbing and capturing.
6. Swimming and capturing.
7. Diving.
8. Stealing upon.
9. Deceiving.
10. Maiming and killing in capture.

In all of these methods skill and prowess are required. Much knowledge concerning the mental processes of the animals themselves is attained, but this will be discussed in a future section.

Among the Eskimo of Hudson bay, Captain Spicer saw a man catching by the flippers a full-grown seal as the latter was escaping into the water. The seal caught its forelimbs over the edge of the ice so that the Eskimo could not draw it back. The hunter, however, turned the seal quickly on its back, dragged it to the shore, and dispatched it in a trice.

Dr Boas saw the Eskimo of Baffinland building a flat snowhouse for the purpose of catching gulls. One block of the roof was translucent, permitting the hunter inside to push his hand through, and when the bird alighted he had only to seize it and pull it through by the feet. The very same process is described by Stephen Powers: In northern California the top of the blind is a brush, to which a dead bird is fastened. As soon as a hawk alighted it was dragged through the brush and his breast crushed between the knees of the hunter.

The Eskimo of Cumberland gulf trample down the houses in which the young seal are born and drag them forth, crushing them to death.

Both the Aleutian islanders and the Fuegians feed on the echinus, or sea urchins, inside of which lie leaf-like masses of ovaries filled with minute eggs. They are eaten raw, and furnish food supply the year round. The Aleut take mussels (*Modiola* and *Mytilus*), which grow about their islands to an enormous size, also sea-bird eggs in great abundance, and they are thankful for a stranded whale.

All along the north Pacific coast fish-spawn is collected from boughs of evergreen stuck in shallow water. When the boughs are withdrawn loaded with spawn they are transported to the hut, where they are hung up, the eggs being devoured as wanted. On the coast of British Columbia the oolakan are so abundant that both men and animals scoop them out of the water. Along the bays and seacoast of Oregon and Washington and the eastern portion of United States, as well as on parts of the coast of South America, shellfish existed in the greatest variety and abundance.

Vast quantities of them were gathered and eaten, leaving immense shellheaps. The Makah Indians of Washington gathered bivalves, barnacles, holothurians, periwinkles, and limpits with the hand, without apparatus, and smoked them and dried them for winter.

There are tribes of Indians on the western coast of United States who catch turbot and flounders with their feet. Wading slowly into the pools, the Indian feels the fish with his feet, and instantly stepping upon it, holds it firmly enough to reach down with his hands and toss it out. Swan says that a large number engage in this sport, and their splashing, slipping, screaming, and laughing make a merry noise.

According to Powers, the Wintun Indians of California dive many feet for clams; they remain down a long time, and rise with one or more in each hand and one in the mouth.

The Big Meadow Indians of California, in order to procure worms for bait, gather their families upon a damp piece of ground, where they dance and sing until the worms seek refuge in the open air, and are gathered with the hand.

The Wailaki of California capture deer by running them down afoot. The deer follow certain trails, and the Indians post relays of men along these, and so give the animal continual chase until he is so blown that he either stands at bay or takes to the water. They also capture rabbits by running them down. They terrify the animals by beating the bushes and screaming until they are easily overcome.

The Micmac Indians of Nova Scotia will run down a stag, commencing early in the day and following it without intermission. The stag outstrips his pursuer at first, but is afterward captured with comparative ease.

According to Adair, the Choctaw caught catfish with their hands. The Yeguases, Davis says, were fleet runners, able to run down a deer, in which manner they frequently caught them. Professor McGee tells of Seri boys who run down flocks of birds, rabbits, and other swift animals, bringing contempt on themselves if they fail. The Pueblo Indians frequently chase and capture cottontail rabbits without weapons of any sort.

Lumholtz says that in warm weather the Tarahumari catch fish with their hands in the crevices of the rocks, and pursue deer in the snow day after day until the animal is cornered. These Indians are among the most famous runners known to us.

The natives of the Antilles are said to have stolen on fish, concealing themselves among the rocks and sea plants, then seizing them with their hands. The Macusi Indian of Guiana dives from his canoe after a particular kind of fish, chases it to the bank, drives it into a hole there, seizes it with his hands, and brings it up. The Mura of the Amazon, according to Bates, dive for turtles and catch them by the legs. Especially is this true in the lakes where they are imprisoned during the dry season.

The distribution of this method of capture is almost universal in both Americas, and is sufficiently exemplified in the foregoing examples.

In hand capture, death is produced by simply removing the animal from its environment. Few savages swallow their animal food alive. Aquatic animals are asphyxiated and killed in the catching of them. Often aquatic mammals are killed by drowning—by holding them under water until they succumb. Burrowing animals are suffocated by simply burying them alive.

SECOND METHOD OF CAPTURE

The second method of taking animals involves some sort of device or mechanism for seizing. Such inventions are more or less substitutes for or accessories to the human hand and fingers. When the hand is held with the palm upward, it is a scoop; the fingers are a rake; the forefinger is an excellent and versatile hook; the closed fingers and hand hold fast and arrest, and the heavy fist or heel of a fisherman is no mean club. It is the inventor's design to imitate them. (See plate II.)

EXPLANATION OF PLATE II

a. Harpoon head for retrieving, showing toggle and barb types in one. U. S. N. M., No. 89,379. Collected by P. H. Ray.

b. Fishgig; shank, body, and flukes of bone. U. S. N. M., No. 30,407. Collected by E. W. Nelson.

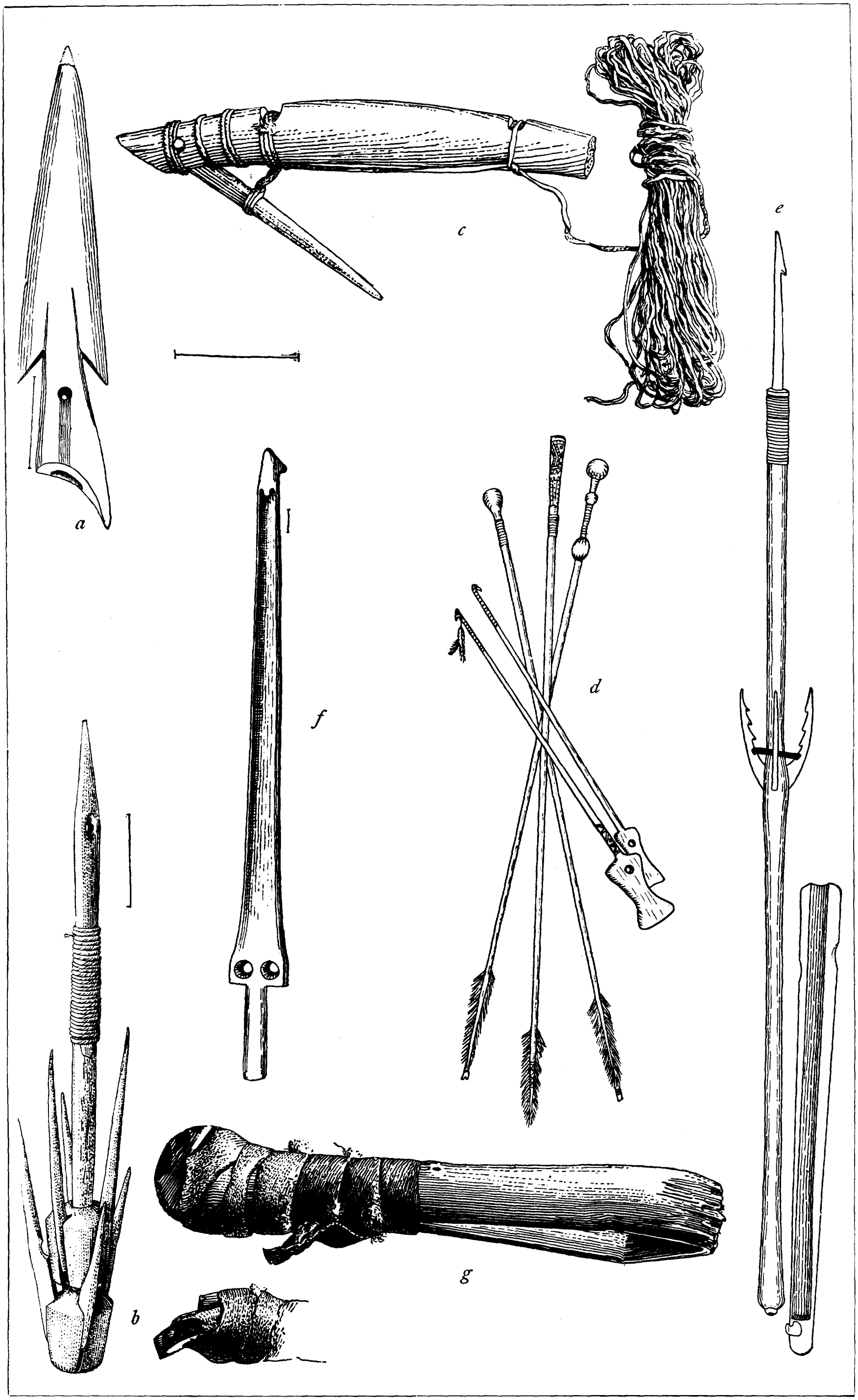
c. Fish-hook from the Naskapi Indians (Algonquian) of Labrador; shank, of wood, split at the lower end to receive the fluke of bone; line of baliche. U. S. N. M., No. 89,977. Collected by Lucien M. Turner.

d. Throwing-sticks and stunning-darts from Xingu river, South America. (After Von den Steinen.)

e. Bird dart, for piercing and entangling, and throwing-board of East Greenland Eskimo. U. S. N. M., No. 168,974. Collected by Capt. G. Holm.

f. Modern atlatl or throwing-stick from Lake Patzcuaro, Mexico. U. S. N. M., No. 153,020. Collected by Capt. John G. Bourke.

g. Hide scraper, with blade of glass and grip of wood, from the Tehuelche Indians of Patagonia. U. S. N. M., No. 178,403. Collected by J. B. Hatcher.



ZOÖTECHNIC IMPLEMENTS

Of the seizing, as well as of other methods of capture, there are varieties based on the fact of distance between the hunter and his game.

The first or primitive variety of seizing apparatus is held in the hand without any attachment of the shaft or handle whatsoever. Professor E. Krause mentions the fact that the Lengua Indians in the Gran Chaco, South America, wrap around the hands a band, to which short, hard spines of fish are fastened. As soon as the hand is closed these spines pierce the skin of the game and prevent its slipping away.

The second variety or class is fitted upon the end of a handle or shaft or thong, of varying length, always having at the working end a hook or loop or other device for retrieving (plate II, *a*).

The third variety is thrown from the hand and has connected with it a retrieving line.

The fourth variety is thrown by means of a throwing-stick or amentum, and is either attached to a retrieving line or is associated with a bow of this class. Many of these retrieving devices, however, are compounded with methods to be discussed later.

The fifth variety of harvesting apparatus of this kind would be discharged from a bow. Associated with the bow will be a retrieving arrow attached to a line by means of which the game may be recovered, as in the Eskimo muskrat arrow.

The most simple kind of taking by hand through devices would be an imitation of the open hand or double palm. The second would imitate the open fingers, used as a rake. The third would take the place of the forefinger or of the bent fingers, acting as hooks. The fourth would act in the way of seizure. All of these pass through grades of evolution or elaboration, becoming more and more complicated as the capture becomes more difficult; and also the classes of inventions herein included will exhibit the varieties of application just mentioned.

As the scarcity of game, even among savages, made the distance greater between it and the hunter, making necessary the development of different kinds of taking, so the noise and terror that came with the gun were the death knell of savage inventions, since they remove the animal out of the reach of all savage weapons.

Scooping devices imitate the open hand or the two hands held together. The dip-net in its multifarious forms is a mechanical realization of this idea, although it is well known that baskets, mats, and all sorts of vessels were used for the purpose of scooping fish from the water when the schools were passing over shallow places. It is a matter of doubt whether nets of this kind were used extensively in America prior to its discovery. Hearne says of the Eskimo that "no appearance of nets was discovered there at their tents or any other part of the shore." Mackenzie, however, declares that the Chipewaian took the beaver in nets, and Schwatka pictures an Aiyan Indian of the Yukon drawing a fish into his canoe with a dip-net.

The Indians of southern United States are declared to have had nets of hemp, and Mr Cushing dug from the muck beds of San Marco, Florida, dip-nets of fine mesh.

At Cook's inlet the Kenai erect stages over the water and dip up salmon in baskets. Swan asserts that among the Indians of Washington the knowledge and use of the net antedate the first white man. In Nootka sound shoals of sardines are driven into the coves and shallow water and scooped up with wooden troughs and wicker baskets. The Modok Indian drags a scoop-net at the stern of his canoe, and when the catch is sufficient, the net is emptied by the fisherman.

The Mission Indians and other tribes of California caught jack-rabbits in nets. The Concow use the same apparatus for catching grasshoppers, of which they are very fond.

Small hand-nets are described as in use by the natives of Xingu river in South America. The Peruvian coast Indian drags a net at the stern of his balsa.

Indeed, some variety of this method of taking game is universally practiced throughout the two continents.

Rake devices imitate the fingers half bent, and are used in gathering mollusks. In several parts of America rakes were made by driving bones into handles, and thus animals were gathered. In many of these, piercing and also retrieving functions are superadded to that of gathering.

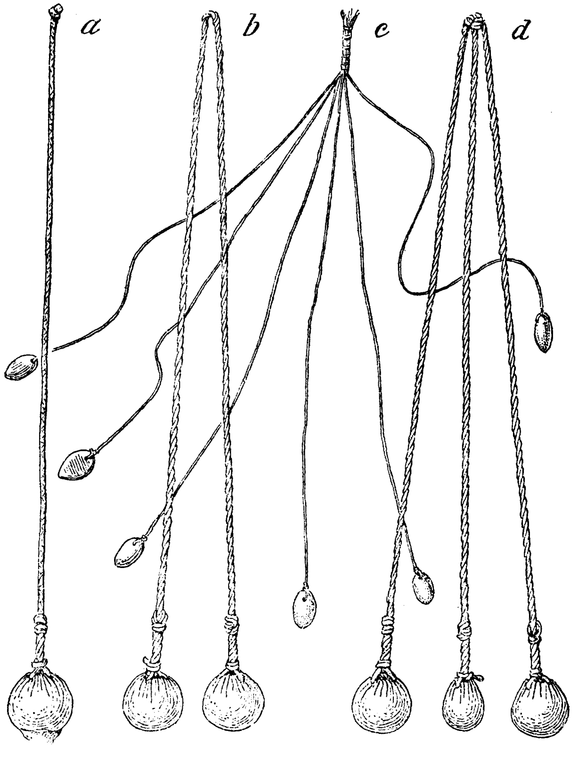


FIG. 1—*a*, *b*, *d*, Bolas for ostrich and guanaco, from Patagonia (U. S. N. M. No. 130,503 ; collected by Leslie Lee) ; *c*, Bolas for water birds, from Alaska (U. S. N. M. No. 75,969 ; collected by P. H. Ray).

The hook resembles the bent finger or fingers. This device has called forth a great deal of ingenuity. Commencing with the crooked finger, there comes the hand aided by the short hook ; the gaff hook ; the hook at the end of a string, or squid hook ;

baited hooks; barbed hooks; compound hooks; automatic hooks; accessories to hooks, such as lassos, sinkers, triggers, etc. It is impossible here to enter into the distribution of this vast collection of material in precolumbian times. It must not be overlooked, however, that angling became vastly more complicated after foreign contact. (See plate II, *b*, *c*.)

Gripping devices imitate the closed fingers or closed hand, and they are represented by all kinds of lassos, bolas, chokers, and hand nooses; not traps, which belong to an entirely different class. The leister is a gripping device to which the function of seizing is added. In some forms this class has a distribution which is not fully worked out. For instance, bolas exist among the bird-eating tribes of Alaska and the guanaco-hunting tribes of southern South America (figure I, page 59). In colonial times trout-noosing existed in the eastern part of the United States.

Birds are caught in California by a running noose at the end of a pole. The Panamint Indians of California seize lizards in this way, and Rochefort describes a "gin having a running knot which is fastened to the end of a pole and cunningly got about the necks of the iguana lizards in order to get them out of the trees."

The distribution of the lasso is yet to be determined.

THIRD METHOD OF CAPTURE

The third method of taking animals is by striking or crushing. In its simplest form it involves only the use of the human body—the fist in striking, and the knee, the heel, or rolling stones in crushing. With increasing difficulty of capture this process is followed by striking with a weight in the hand, with a club, with a sling-shot or *bola perdida*, with a dart-sling or throwing-stick, with a sling or stone-bow, and with a blunt arrow. The beginning of such a series would be the fist, and the termination, the cannon-ball. Among traps the dead-fall occupies the same position.

In the Arctic regions, and, indeed, one might say universally throughout America, the club is an implement of capture either alone or in connection with other implements. In some areas the club is an unadorned killing device, in others much skill is expended on it in decorations that are either totemic or sorcerous, and in its most efficient form it cuts or pierces as well. Throughout the buffalo country a peculiar form of club prevailed, and it is still seen, by the way, down to the borders of Mexico. A ball of stone is enclosed in a rawhide bag which is loosely attached to a short handle, after the manner of a flail.

On the western coast of the United States the sling begins to appear. Powers says that the Copehan tribes killed wild fowl with a sling, using bolas made of hard-baked clay. Ray also brought the sling from this region.

All over the southwestern country the non-returning boomerang is common. Lumholtz says the Tarahumari Indians kill birds with stones.

Gemelli Careri says that the Indians " kill " small birds on the highest trees with pellets shot out of trunks. The sling, however, had its greatest use and distribution on the cordillera of South America. The tribes of the Mato Grosso used a stunning dart with their throwing-sticks. Stunning arrows, sometimes bird arrows with blunt heads, are found all the way from the Arctic Eskimo to Argentina (plate II, *d*). Wells mentions the use of the sling in Tierra del Fuego.

FOURTH METHOD OF CAPTURE

The fourth method of taking animals is with an edged weapon. The sword is the acme of all such inventions. In the almost entire absence of wrought metal, throughout America, slashing weapons were of stone, bone, or hardwood. The rapidity with which natives in all parts of this hemisphere adopted the use of iron and steel prevents the present examination of the method of using the primitive edged tools. However, there is no spot on either continent, where available material is to be found, that does not reveal the universal use of the hunting knife. The simplest example of this in the National Museum has a leaf-shape, chipped blade, one end of which is wrapped with a long strip of otter fur to serve as a handle.

Departing from this starting point, it is easy to trace the edged weapon through the knife, the American form of the *pattu pattu* or stone swords, the style common among the Sioux and in Mexico of inserting blades into a club.

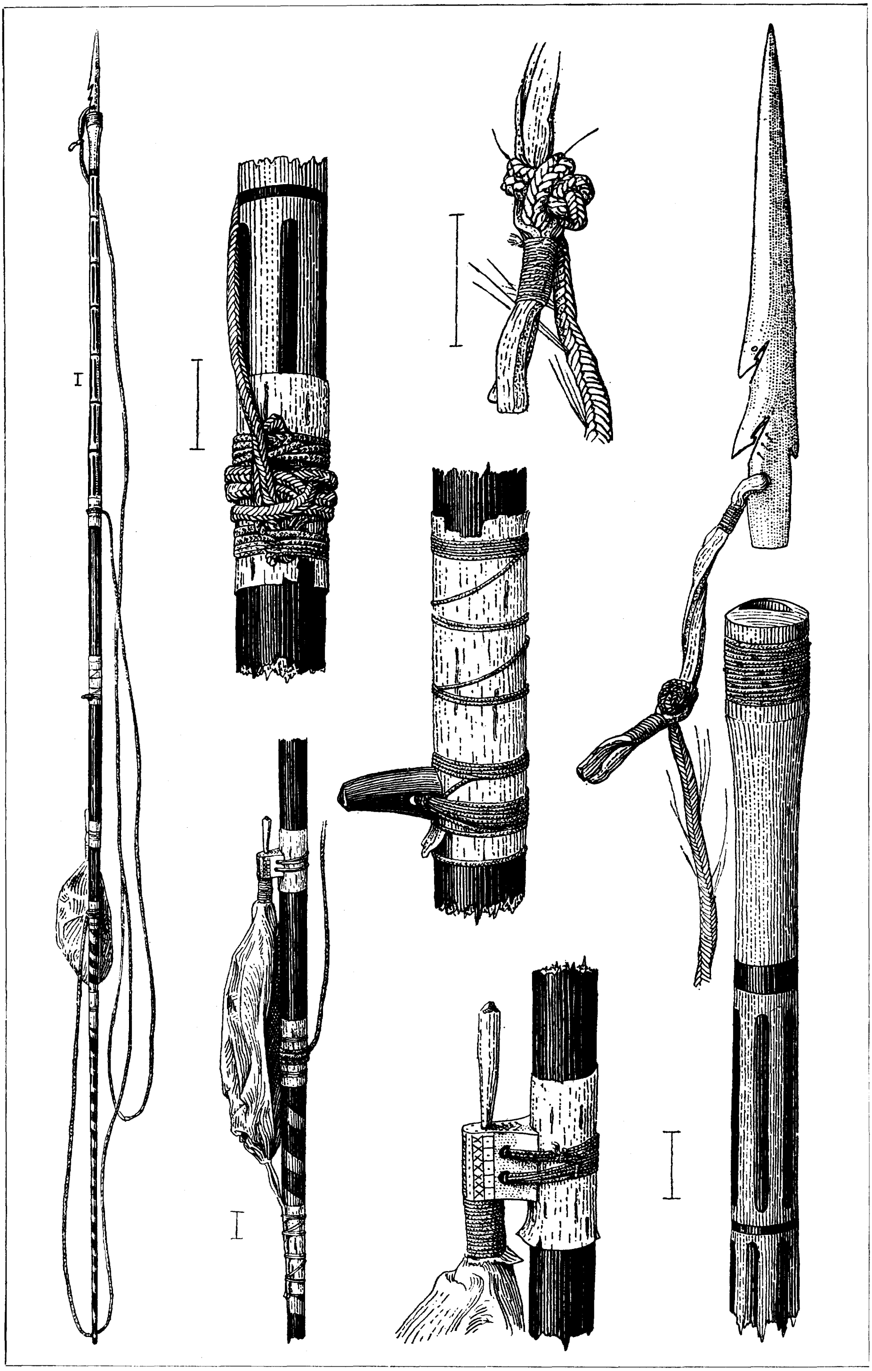
The *macana*, described by Hawkins, in 1593, as "a sword of heavy black wood some four fingers broad, an inch thick, and an ell long, something broader at the top than at the handle," has wide distribution in South America. The edged or cutting arrow, common in various parts of the eastern hemisphere, is not known to have existed in America.

FIFTH METHOD OF CAPTURE

The fifth method of taking animals is with some piercing device. These devices are far more numerous than those employed in all the other methods, and have been subject to the widest differentiations of form and complexity of development. A full discussion of those on the American continent would far transcend the limits of this paper.

Piercing devices begin with a thorn or sharpened bone held in the hand. When the point has a short handle, it is a dagger; when it has a long handle, it is a lance; if the point is barbed for retrieving, it becomes a spear; when shot from a bow, it is an arrow; when hurled from the hand or throwing-stick, it is a dart; when it has a detachable point, it is a harpoon, and these may be either barbed harpoons or toggle harpoons. Above these simple forms there are many that involve two or more of the processes named. A great many of them serve the double purpose of piercing and retrieving. (See plate III.)

The lance was used anciently for stabbing, and it could be withdrawn; it exists with a point or blade of chipped stone, bone,



BARBED HARPOON

Barbed head and hand-rest of bone; long-shaft of wood; line of sinew; float of seal bladder. When the animal is struck the barb is detached and the shaft is made to float vertically by the martingale and bladder. (U. S. N. M., No. 11,362. Collected by Vincent Colyer.)

or shell, or with one hardened by fire. Every Eskimo kaiak has among its multifarious accouterments a large stabbing lance which may be driven again and again into the seal or other animal. The western Eskimo have a form of lance with detachable points that are left in the animal. Each hunter carries a bag of them, and when he comes in close quarters with a walrus or other game, he plunges one after another into the beast until it is killed. Blades of iron have universally taken the place of stone and other substances. The Cree Indians extemporize a lance by lashing a hunting knife to a long pole. On the Mosquito coast the turtle is struck with a lance having a point like a file and without barbs. A spear in this connection is a lance with barbs on the point, and the bird, mammal, or fish is transfixed and retrieved.

In the Eskimo area the bird-spear, so called, exists universally; that is, the points at the working end are barbed, and there are barbed pieces also on the sides. These perform the function not only of transfixing, but, as mentioned in a former section, of entangling and grasping. The fish-spear exists in great profusion throughout Eskimo territory where fish are in abundance and may be captured by spearing (plate II, *e*).

An interesting group of devices for piercing are the bows and arrows. The following table will set forth the types of these weapons in the areas named:

1. Arctic area; compound bows in the east, sinew-backed bows in the west.

2. Athapascan area; long, straight bows of willow and birch with wristguard on the bow.

3. Algonquian-Iroquois; plain or self-bow of hardwood—ash, hickory, osage orange, and oak.

4. Muskhogean bow; long, with rectangular cross-section, of walnut and other hardwood.

5. Rocky Mountain bow, in two varieties—plain or self-bow of Bois d'Arc, and a compound bow of buffalo horn in two or three pieces, wrapped and strengthened.

6. North Pacific bow; round grip and flat wings, generally of yew or cedar.

7. Columbia River bow; similar to number 6, with wings much shorter and the necks sharply incurved.

8. Interior Basin bow; a long, slender stick, lined on the back with shredded sinew, strengthened by cross-wrapping here and there.

9. California bow; like number 7, but neatly lined with sinew and ornamented.

10. Pueblo bow; like number 8, but frequently without backing. In the southern portion of this area long cottonwood bows with cross-lashing are used by the Yuman and Piman Indians.

11. Middle American bow; hard palm wood, long and rectangular in cross-section; in the northern portion, short and flat.

12. Antillean bow. Little is known of this type, but probably it resembles the types of the Venezuela and Guiana regions, which are long and slender.

13. Cordilleran bow. Wherever the sling was predominant the bow was not much used, and this is true of the highland regions of South America. The Amazonian type intrudes here.

14. Upper Amazon bow; of palm wood, rectangle or long ellipse in section.

15. East Brazilian bow; of hardwood, semicircular in section, mixed southward.

16. Mato Grosso bow; bows of the east and west overlapping.

17. Argentina bow; of hardwood, small, round in section, disappearing after the introduction of the horse.

18. Fuegian bow; round in section and small.

No less interesting than the bow is the arrow in its geographic distribution throughout the western world. On the whole, the structure has not been materially changed by the introduction of metal, iron and brass taking the place of stone and other substances.

1. Arctic arrow. In the treeless Eskimo region the arrow-shaft is made of driftwood or of small pieces from wrecks spliced together and tipped originally with bone, most of them being barbed either for deer hunting or for fishing.

2. Athapascan arrows differ a little from Eskimo arrows, especially those that are designed for killing caribou.

3. The Algonquian arrow had a simple shaft (but no foreshaft), feathers, and head of chipped stone, fastened on the top with sinew; but in the fishing regions all sorts of barbed pieces replace the stone, each having one or more barbs.

4. The Muskhogean arrow was made of reed cane, and had wooden as well as stone points for different purposes.

5. The Rocky Mountain arrow has a short, hardwood shaft with blood streaks, and formerly a head of stone, but this is now replaced universally with iron.

6. The North Pacific arrow has a shaft of cedar with two flat or three radiating feathers, and a head of bone or iron. These are better made than the arrows of the Eskimo.

7. The Columbia River arrow is neatly made with a shaft of cedar and a head of two or more prongs, usually barbed.

8. The Interior Basin arrow resembles that of the Rocky Mountain region, though on its western side it merges into that of the Columbia River region.

9. The California arrows differ in special characteristics from place to place, but all are delicately made with light shaft, hard foreshaft, fine obsidian or stone point, and three feathers, usually highly ornamented.

10. Of the Pueblo arrows there are two kinds—those made under northern influence have a single shaft, while those made under southern influence have a reed shaft and hardwood foreshaft with points of stone or glass.

11. The Middle American arrow is long and has a shaft of reed with flat feathering.

12. Antillean arrow. According to Hermann Meyer the arrows

of the southern region are best distinguished by their feathering. In the Guiana foreshafted arrow there are two short half-feathers bound to the shaft with seizings of fine thread. This is also the region of the blow-tube and curari poison.

13. Cordilleran arrow. Where the arrow exists in this region the feathering resembles that of the next group.

14. Upper Amazon arrow. Two feathers attached to the shaftment with black cement and held in place by a spiral winding of thread.

15. Eastern Brazilian arrow. Two whole feathers fastened by their ends with thread or bast frequently laid on in patterns.

16. Mato Grosso arrow. Great confusion of arrows of different types.

17. Argentina arrow. Two feathers wrapped and cemented.

18. Fuegian arrow. Diminutive arrow with very short feathering and delicate point.

The blow-tube is a tropical invention confined to areas where the cane abounds and also where bows and arrows are not serviceable weapons. The two areas of its full development are South America and Malaysia. The weapon consists of a straight tube of cane and a short arrow; at the base of the latter wadding is wrapped. Frequently the points of the little darts are poisoned.

The weapon of the western continent is somewhat better adapted to wooded regions where abound monkeys and birds of beautiful plumage. It is found sparingly in southern United States. The Chetimacha of Louisiana used a compound weapon in which four or more tubes were lashed together as in a pan-pipe.

In Venezuela, Guiana, and eastern Brazil abound the *zarabatana* (also called *gravatana*) and *pucuna*. They are mentioned by E. F. im Thurn, Schomburgk, Wallace, Simpson, and Bates. The Caribs insert a tube of palm wood into a stem of *Arundinaria schomburgkii*.

Instead of reeds the Napo Indians use a tube made in the following manner: A good piece of *chonto* palm, the hardest palm found in the country, is selected and a groove cut into it with a knife, to the length of about 7 to 9 feet. This groove is then scraped and rubbed with sand, finer and finer, until it assumes perfect smoothness. Another half tube, exactly similar, is made, and the two are then bound together with wax and fiber, the result being a long, heavy pipe with a bore about three-eighths of an inch in diameter, which on examination proves to be almost as true and polished as a gun barrel. Through this the insignificant though deadly poisoned-tipped darts are blown with unerring precision, conveying silent and sure death to their mark.

Next to the bow and arrow the most complicated piercing weapon for hunting is the harpoon, which may be described as a retrieving spear with a movable head. It may be either barbed or toggled. The barbed harpoon is universal in America, and the toggle exists in some areas in a very simple form; but the whole outfit of the Eskimo in the use of this apparatus, and the apparatus itself, form a most intricate device for hunting.

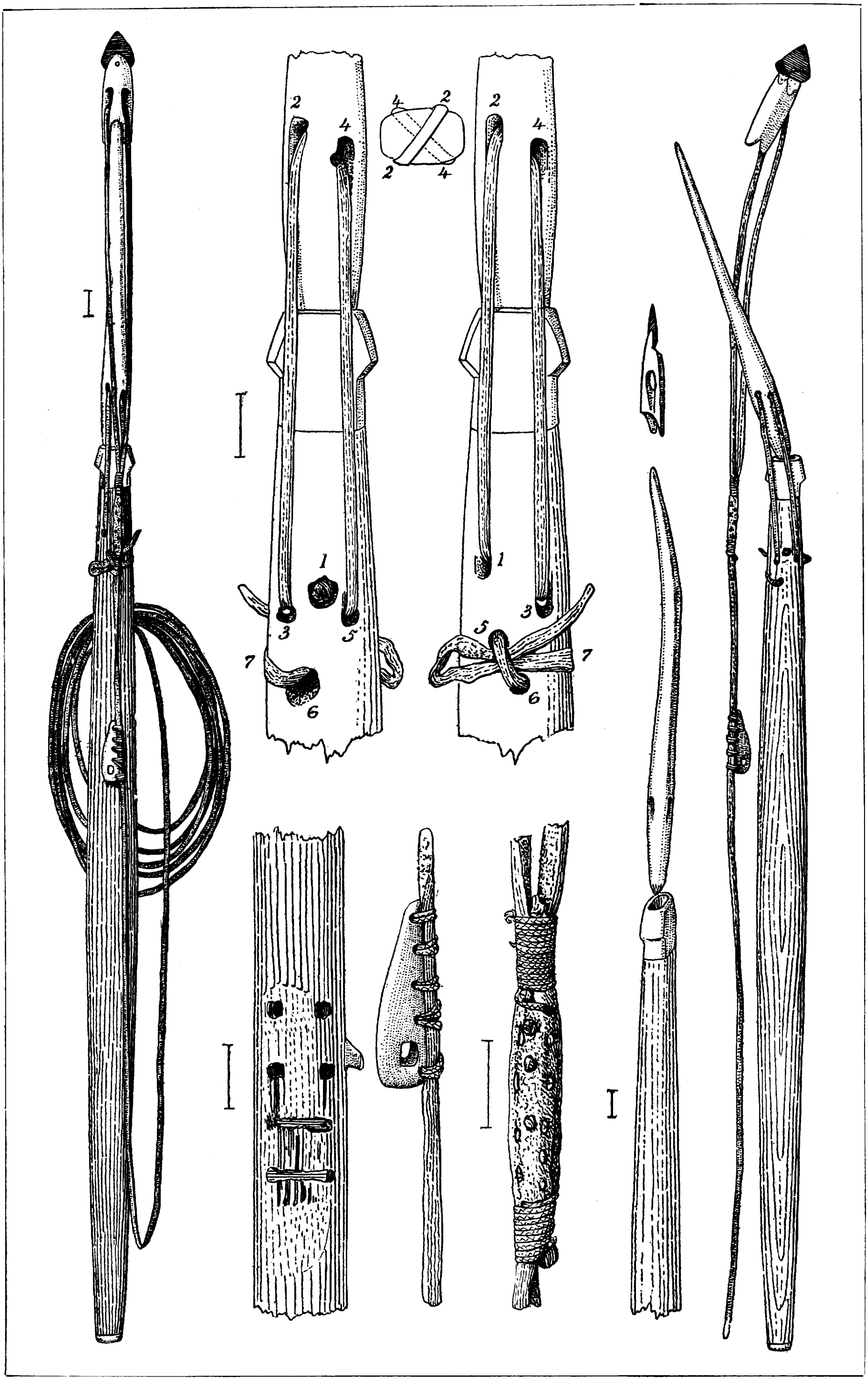
From old graves in Greenland and other Arctic areas toggle heads have been found which show the transition from the barbed head to a very simple form of the toggle. Examining these in comparison with the latest forms proves that Siberian, Russian, and European influences have combined with Eskimo ingenuity in developing the modern form. Even for this most improved type there are varieties differing in size, material, shape, and relationship of the parts according to the environment, the animal to be captured, and the intelligence of the maker. So we have whale harpoons, walrus harpoons, seal harpoons, hand harpoons, thrown harpoons, retrieving harpoons, and harpoons with floats.

The Giliak long pole and float combined do not extend in America, but eastern Greenlanders have a small sled to carry the point on the ice which corresponds exactly in function with the Giliak float. They also have a deep-sea harpoon with long shaft, operated by two hunters.

The parts of a toggle harpoon head are the toggle head, the body of the head, the spur, barbs, blade, shaft hole, line hole, grooves, and leader or short line (this works on a loose shaft of varying form hinged to the shaft), foreshaft (which differs in material and shape, joining with the shaft), socket for the foreshaft, and accessories. Shafts differ in material, in length and size, in the number and position of the pegs, in the hand stop or rest, in the laying on of the assembling line and ice pick. Add to this the floats, float rack, and other appurtenances on the canoe or kaiak, and it will be seen how excellent an object for studying distribution and development for technique this weapon becomes (plate IV).

In a more extended work on zoötechny the discussion and distribution of the barbed and toggle harpoons throughout the western hemisphere will be fully set forth.

Closely associated with the harpoon is the so-called throwing-stick, or dart sling, or harpoon sling, or Mexican *atlatl*. It is a piece of wood or reed, the working end of which is a hook of some sort to engage the but-end of a dart or harpoon. Its manual end may be merely rounded for a hand grip, or it may be carefully wrought out to fit the right hand of the hunter. The device practically adds another joint to the hunter's arm. With specific variations it is found from Greenland to Siberia among the Eskimo; it occurs also in southeastern Alaska, down the Pacific coast to Columbia river, among the cliff dwellers of the Interior basin, in the keys of southern Florida, and thence southward through Central America to Colombia, on the upper Amazon, in the Mato Grosso, and in eastern Brazil. In the Report of the United States National Museum for 1883–84 the writer published a paper on Eskimo throwing-sticks, since which time many contributions have appeared relative to this curious invention (plate II, *f*). Among the writers should be named Kristian



TOGGLE HARPOON AND LINE FROM CUMBERLAND GULF

U. S. N. M., No. 19,519. Collected by G. Y. Nickerson

Bahnson, G. W. Lüders, Adrien de Mortillet, John Murdoch, Zelia Nuttall, C. H. Read, Edward Seler, Hjalmar Stolpe, and Max Uhle.

SIXTH METHOD OF CAPTURE

The sixth method of taking animals is classed under the general name of traps. In the second, third, fourth, and fifth methods the animal succumbs to force. The prevailing thought in the mind of the captor is that of seizure and destruction without consulting the desires and idiosyncrasies of the animal; but in the whole class of devices enumerated under the general term traps, the psychology of the victim is seriously considered, and the game is not killed or violently captured, but induced by various deceits of the hunter, who may be absent or concealed, to commit suicide or self-incarceration. In one place the bird comes unsuspiciously to its accustomed roosting-place and is held fast by a bird-lime or a snood encircling its feet.

The whole class of destructive weapons is imitated in the trapping devices; animals are seized by the foot or by the head; they are stunned by a blow; they are seriously cut with a blade; they are pierced in some vital part, or they are induced or driven into an enclosure from which they cannot escape.

Indeed, there is no great gulf fixed between the foregoing classes in which man, as an active agent, is present, and the trap; some of the latter are operated partly by the victim and partly by the hunter concealed, as in the case of the fall trap used by boys for catching snowbirds. The little stick which supports the weight is fastened to a long string that is pulled by the concealed hunter when a sufficient number of birds have come in.

When the minutiæ of the traps are considered, one might almost say that there is a different mechanism for each species of animal. The parts of a trap are, as in tools, the working part and the manual part (or that which takes the place of the human hand), together with such intervening devices as render these coöperative.

Many additions to the language have been made by the trapper, such as springe, snare, gin, pit-fall, dead-fall, gill-net, noose, enclosure, pound, creel, weir, and others.

There is also an opportunity in this division of the subject to study elaboration or perfection. For instance, among the most primitive people exist forms of driving animals into some sort of a corner, or enclosure, or pit, or body of water, and even fishermen construct rude fykes and fish traps into which large numbers of fish are driven, and this finally leads to the development of the regular fykes in our rivers.

The net in this connection has a very extensive development. One form of this apparatus was mentioned in the second division of this subject—the method of taking by hand,—that is, the scoop-net; but the set-net, the gill-net, and the fyke combined gave rise to a great variety of trap structures.

The snare in its simplest form is a noose set in the way of animals that go in trails or paths, but later is manifested by the addition of a spring as in the ordinary rabbit springe of the country boy.

The greatest ingenuity, however, is manifested in the structure of what is generally known as traps. Under this name are included, on the American continent, stomach springs, closing pen-traps, clutching traps, fall traps, cage traps, empalement traps, and missile traps. These may be divided according to the method of preparing them for their work into man-set, self-set, ever-set, and victim-set.

SEVENTH METHOD OF CAPTURE

The seventh method of taking animals is by the aid or help of other animals, either as decoys to lure the victim to destruction, or, as dogs and other hunting animals, to chase down or kill.

The remora, however, used by the people of the Antilles for taking larger marine animals, is a fish which, by means of a sucker, attaches itself to the prey and is retrieved by means of a line attached to its body. In this case the hunting animal is really a living capture device (second method).

Insensibly, animals in contact with savage tribes enter into the thinking of these tribes. Not only are the people modified because of the existence of the helpfulness of these animals, but the animals themselves become modified and helpful to the people or suspicious of them ; their whole conduct is changed.

A story is told of a traveler in the Andes, in company with an Indian guide, being informed of the existence of animals of prey actually engaged in devouring a victim simply by the flight of birds overhead. Examples of this unconscious intercommunication and helpfulness are innumerable.

The one animal that has been most helpful to man on the western continent, in the matter of hunting, is the dog, especially in the Arctic regions.

EIGHTH METHOD OF CAPTURE

The eighth method of taking animals is by means of fire through its phases of heat, light, and smoke. The light of the torch serves a double purpose, it illuminates the area of hunting and confuses or attracts the game.

The Seneka are said to have hunted deer at night in canoes, having a wax candle fastened to the bow. The Indians of Puget sound also used a torch to hunt elk, deer, and waterfowl at night. In the case of the latter they erected tall poles to which nets were stretched; when they held their torches behind the nets the migrating birds would fly against it and fall to the ground. The California Indians, as well as the eastern Indians, fished by torchlight.

Squier describes fishing on the Mosquito coast by torchlight made of bundles of fat pine fastened to the top of a long pole. Indeed, the tropical tribes, especially in the Antilles, were accustomed to use torches in fishing with dip-nets in the rivers at night. It is said that the Indians of Chesapeake bay formerly would light torches in their canoes at night, and that the fish, attracted by the light and attempting to jump over the boat, would land inside. At times the fishermen were compelled to put out the light to prevent the fish from sinking the boat.

Fire was used also for burrowing animals out of their dens; but the most exciting and effective use of fire for hunting was by the Indians of the plains of the great west. In their annual buffalo hunts large droves of these animals were corraled by means of fire.

The "Digger" Indians of California employed fire in corraling rabbits. In doing this they also obtained large quantities of grasshoppers, the fire having merely singed their wings. "As the squaws picked up the insects they crushed the head between the thumb and finger to kill them, and then tossed them over their shoulders into their conical baskets." These were used for food.

NINTH METHOD OF CAPTURE

The ninth method of taking animals is by poison. This term is used in a general sense and applies to all methods of capture in which the digestive organs are attacked.

Cabeza de Vaca noted the practice of poisoning in Florida. Adair says that it was general throughout the southern states. Dr Chesnut, of the Department of Agriculture, mentions among the poison plants of southeastern United States a horse chestnut (*Æsculus pavia L.*) used in stupefying fish. The California Indians, when the streams run low and the fish collect in deep holes, cut off the water from above and use soap root which soon causes the fish to float upon the water. The Countess di Brazzà says that the Pima used large quantities of *Sebastiana palmieri* for poisoning fish. Lumholtz makes the same assertion with reference to the Tarahumari Indians of northern Mexico, and Squier gives an interesting description of the poisoning of fish by the Payas of Honduras.

Brinton mentions the Moguexes, in southern Colombia, who stupefy themselves with stramonium, which they use also in catching fish. The Gentleman of Elvas says that in Peru great abundance of fish were asphyxiated in this way and then killed with clubs. The Indians of southeastern Brazil use a number of leaves, as well as roots and bark, for this purpose. The tribes of the lower Amazon and of the upper Negro poison fish in the same manner. Von den Steinen says that the Xingu tribes do not poison fish.

The use of poisoned arrows by the North American tribes is a mooted question and would not apply to hunting; but in the study of poison in the capture of animals one should not overlook the question of the curari poison in the northern portions of South America, especially among Carib tribes.

An enormous bibliography of this subject is to be found at the Surgeon-General's Library in Washington, and also in the great *Index Catalogue* of that library.

ACCESSORIES OF CAPTURE

Besides the apparatus used immediately by the hunter to kill or to secure his game, there are a thousand and one accessories thought to be indispensable. In the pursuit he modifies his dress or has special cover or protection from the weather.

John Smith says that the Indians carried mats to kneel on in their canoes when they went on hunting expeditions, and when they landed they used the mats to make huts.

Nelson records the fact that the Eskimo of Norton sound carry wooden plugs in their canoes, and when a seal is stabbed the hunter blows up, with his mouth, the skin of the dead animal, and, thrusting one of these plugs into the hole, renders the animal buoyant so that the hunter may tow it ashore.

Every invention designed to assist the hunter in approaching the game, or dispatching it, or carrying it home, or protecting himself, may go under the general title of accessories to hunting. It is quite possible that in this association the invention of fire making and of condensed food for long journeys took place. Here belong decoys, ice-creepers, and snowshoes.

In Drake's *The World Encompassed* there is a very vivid description of a rhea hunter who "carries a great and large plume of feathers on a staffe, in the forepart bearing a likeness of the head, and necke, and bulke of an ostrich."

The seal hunter draws his hood over his head, lies down on the ice, and approaches the victim by stealth, taking advantage of its forty winks.

Before the intrusion of the gun there is no doubt that wariness, sound and sight decoys, and disguises of all kinds were in universal use in the western hemisphere. The author has collected a large number of these appeals to the eyes and ears of the game in order to get within reach of the dispatching weapon.

DOMESTICATION

The domestication of animals is not, strictly speaking, a mode of capture, and yet, when the processes by which wild creatures are brought under the domination of man are understood, it will be found that it is a slow and insidious method of capture. In fact, all vermin and other noxious creatures are self-domesticated. The ox, horse, ass, camel, sheep, goat, and hog came to man slowly and in droves. On the western hemisphere they antedated man, existing now as fossils or poorly allied species. Few of these congeners were domesticable. Professor McGee has drawn attention to the subtle manner in which the animals in our southwestern regions have come into diplomatic relations and compromises with the Seri and Papago Indians.

The dog in both Americas, the peccary and the llama in South America, for pets, for hunting, for packing, for travois, or for traction, were the farthest advanced in the school of domestication among the animals of the western hemisphere; but every tribe had, in addition to these, birds and beasts which responded to some desire of the adults or children or have come under their sway. Among these partially subdued creatures were schools of fishes and herds of ruminants corraled to be killed ad libitum. Around nearly every southwestern pueblo there are cages for the incarceration of wild creatures, and the snakes for their ceremonies are gathered in pits. The Mexicans made special houses for birds and beasts. E. F. im Thurn calls attention to the interminable chatter of pets about the Indian habitations in Guiana, and says the racoon (*Nasua socialis*) is more often seen tame than wild. The peccary was partly tamed both in Mexico and on the Amazon. The whole subject of domestication on the western continent has been laboriously worked out by Payne.[1]

III. PROCESSES IN ZOÖTECHNY

The third division of zoötechny embraces all the activities included in the disposal of animals after they are in hand.

It was mentioned in the beginning of the section on "Capture" that a great many of the animals taken by savages are eaten on the spot, but even of this simple harvest much is carried away, and this involves, therefore, the methods of carrying in use from region to region, and hence the vast array of transportation utensils. On the waters, frequently the freight boat is different from the hunting boat; on the land, in the Arctic region, the small freight sled is much clumsier than the traveling sled, and here we have the origin of sleds and of shipbuilding. The pack-saddle and travois for dogs were used by the hunters chiefly in conveying their game, and it would not be difficult to find in any museum a collection of hunters' devices for bringing home the fruit of their labors. Even the special craft for fishing are modified so that the hunter may not only take his game, but may freight it home.

The butcher's art of cutting up the carcass, and the smoking and drying of fish, mollusks, and flesh, require considerable care, labor, and ingenuity. The forming of store-houses, storage pits, and caches, in which a supply of meat is laid up for the future, was an industry practiced to a large extent in both Americas.

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[1] Payne, Edward John, *History of the New World called America*, Oxford, 1892, vol. I, pp. 311–331. Consult also B. Langkavel, *Hunde und Naturvölker* (*Internationales Archiv für Ethnographie*, Leiden, 1895, vol. VIII, pp. 109–149), with copious bibliography.

All the tribes of the United States and of British America were known to have dried and smoked both fish and flesh. The Nootka Indians procure the oil of the whale by placing the blubber in boxes and melting it with hot stones. The Alaskan British Columbia tribes dug circular pits both at their homes and around their fishing places, lined them with dry bark, and filled them with salmon, covering the hole with bark and earth. The Indians of Puget sound dry large quantities of clams and fish eggs. The Virginia Indians practiced the same art.

The hides of animals were not less the means of developing the inventive faculty. Leaving out the machinery for harnessing power, modern tanning involves no new processes of unhairing, fleshing, tawing, and manipulating hides. (See plate II, *g*.)

In the mechanical processes, the bones, sinews, skins, teeth, horns, hair, intestines, shells, and spines of animals supply hammers, knives, wedges, levers, saws, awls, drills, scrapers, files, clamps, thread, string, rope, thongs, vessels, boxes, and bags. The knife is the beaver tooth or shark tooth; the gimlet is the spine of the ray fish; the saw is the jawbone of some rodent; the sandpaper is the skin of the shark, the palate bone of fish, or mollusk shells; the skin scraper is the leg-bone of one of the large ruminants. So all tools for all purposes may be derived, in some way, from the bodies of animals. Von den Steinen was so impressed with the absence of stone in the Mato Grosso and the universality of animal substances for the materials and tools of industrial operations, that he suggests for culture epochs the terms Bone age and Shell age.

IV. PRODUCTS

Zoötechny concerns itself with the productions of its processes and the way in which they enter into the arts of consumption and enjoyment. Every part of every animal that enters into savage industry is invoked to supply, as just shown, not only the needs, but the artificial wants of the savage.

Looking at a modern house, it is easy to see that it is divided into cellars or storage places, kitchens or cooking places, dining-rooms or eating places, parlors or places for social intercourse, and bedrooms or places for rest. Though these do not exist in differentiated form among savages, in every tribe of North America, however rude, there was something answering to them. The great variety of food called for an equally great variety of cooking, and so the fireplace and its surroundings, with reference to animal food, gave rise to a multitude of arts. In one place, it is roasting; in another, cooking with hot stones; in the third, in pits; in the fourth, by means of pottery, and so on through the list. The serving of food calls for eating and drinking utensils of horn, shell, hide, and bone. The Eskimo makes a dipper from the tusk of a fossil elephant; the Haida, from the horn of the Rocky Mountain sheep, the handle of which is from the horn of the goat; the buffalo horn served well the Indians of the plains; the clam shell, the eastern tribes; the turtle shell, the western tribes; the conch shell, the middle American tribes. In large areas of the western hemisphere no pottery exists, and some portions of the animal frame take the place of vessels made from that material elsewhere.

The furniture of the social room and the bedroom are made from animal integuments. The Eskimo crawls into his sleeping-bag of fur; the west-coast man wraps himself in his blanket of mountain-goat hair; the plains Indian could not live without his buffalo robe; the eastern Indian lay down in his bear skin.

In southwestern United States everywhere the babe was enfolded in a robe of rabbit skin, and even in those parts of South America where the climate requires no clothing the Indian appears decorated with beautiful cinctures of feathers and wearing hats and collars of animal teeth. Finally, at the extreme southern portion of South America the robe of a guanaco skin and the plumage of the ostrich complete the habiliment.

The house itself shares this dependence on animal materials. The Eskimo, lacking timber, supports his roof with the jawbones of whales, and in summer, in common with his Canadian neighbors, he dwells under rude skin tents. Southward, in woodless areas, the conical tipi is the house, and in Patagonia it is the toldo of guanaco skin. The textile of hair and quill, furnished by innumerable birds and by porcupines, dogs, sheep, and notably by the llama, vie with basketry, pottery, and sculpture in giving expression to the highest esthetic and mythic ideals.

V. SOCIOLOGY

The fifth inquiry concerns the relation of zoötechny to sociologic problems. Society was organized among the aborigines of America on the basis of the animals. Even among the agricultural Indians of the pueblo region this is true. Again, scarcely an industry relating to the treatment of animals was based on individual action; men were fowling, fishing, and hunting together. Much of the apparatus could not be managed by any individual, and even where such a weapon as the harpoon or bird-spear was employed, men hunted with ease in groups.

The driving and corraling of game required coöperation. Dupratz, Lawson, La Hontan, Charlevoix, Loskiel, Perrot, John Smith, Roger Williams, and Champlain all speak with enthusiasm of hunting excursions by entire villages. Von den Steinen mentions the same method of coöperation among the people of the Mato Grosso in South America, and even now in the backwoods of the United States game and fish driving for sport is practiced.

Also, in this connection must be noticed that important study of the division of labor. Men usually attended to the more difficult portions of the work, while the women made the preparations, cooked the food, manufactured the clothing, and took care of the spoils of the hunt.

Bandelier speaks of communal hunts both in New Mexico and Peru, which he characterizes as wholesale slaughter, in the most cruel manner, of all the game within the area encompassed. The meat was distributed among households and a portion was put away for a rainy day. The pueblo peoples also laid in communal stores; small tracts were cultivated for that purpose and the crops were housed in advance of the individual ones. General Dodge in *Our Wild Indians* grows excited over the annual fall hunt of the Siouan people.

In the last chapter will be shown how sociology joins with religion in fixing zoölogical conceptions on tribal life.

VI. KNOWLEDGE

In all the processes of zoötechny human intelligence has been enlarged and strengthened. The ever-increasing wariness of the animal calls for an increasing ingenuity and intelligence on the part of the hunter.

It is a fact that in every one of the eighteen environments mentioned in this paper the savage people knew the best thing for every purpose: the best substance for clothing, the best wood for the bow, for the spear, the arrow, etc.; and it is astonishing to find what a large vocabulary exists in each one of them for different forms of animal life and different parts of the animal's body. For every thought in this direction there must of course be a word or a form of speech. Therefore, language has been assisted materially in its development by the imitation of the animal, by the processes and the life of the hunter, and by all the industries associated therewith. The acquisition of knowledge through experience and the expression of this knowledge in words have been fostered largely by associations with animal life. Half the words of any primitive language are derived from man's association with beastkind.

Finally, the inventive faculty, which after all is the differentiating element between man and the brute, has been stimulated in the devising of property, means of capture, and tools for handling animal substances. The truth has gradually emancipated itself from the overgrowth of the imaginary, and an aboriginal empirical science of no mean proportions has been elaborated.

VII. RELIGION

Finally, in lower forms of religion and mythology, zoötheistic conceptions are prominent. Every creature is somebody. The animal world lies very near to human actions. Nearly half the totemic names gathered by Mr Hodge among the Pueblo Indians are those of animals.

The folklore and mythology of zoötechny would require a separate paper. Every tribe has its long and delightful faunal myths. Even in the pursuit of animals there are folk customs and folk beliefs that form a part of the history of religion.

The California Indians, after the acquisition of iron knives, still insisted, for superstitious reasons, on using flint and jasper flakes to cut and skin salmon, especially the first in the season. Fisher says that the wooden hunting hats of the sea-otter hunters, south of the Alaskan peninsula, are highly prized because they have the power of attracting the game, and a hunter who would part with his hat would lose his luck. Matthews in his *Mountain Chant* speaks of the old Navaho hunter taking four good sweats and lining the floor of the sudatory with the branches of sweet-smelling trees. Parkman saw an Ogalala Sioux consulting an enormous black cricket as to the position of the buffalo. Of this lore there is no end.

The Eskimo have not the gentile system, but on all their masks as well as in their carvings and etchings the overpowering influence of animal life is apparent. Among the stocks of the western coast down to Vancouver island the one obtrusive feature of the life is the totem post, the totem carving, etching, and painting, with nearly every motive from the animal kingdom. Of the Indians of the United States and Canada the following list will convey some idea of the source of all mythological conceptions:

Tribe	*Clans or Gentes*	*Animal Totems*
Carriers (Athapascan)............	4	4
Navaho[1] “	51	0
Apache[2] “	34	0
Seneka (Iroquoian)..............	8	8
Onondaga “	8	7
Cayuga “	8	7
Oneida “	3	3
Mohawk “	3	3
Wyandot “	8	8
Tuskarora “	8	8
Cherokee “	8	3
Mohegan (Algonquian)	11	11
Ojibwa “	23	23
Potawatomi “	15	14
Miami “	10	7
Shawnee “	13	13
Sauk “	14	10
Bloods “	5	5
Piegan “	8	1
Delaware “	34	not given.
Abnaki “	14	14
Ponka (Siouan).................	8	6
Omaha “	12	7
Iowa “	8	8
Oto “	8	8
Kansa “	14	14
Winnebago “	8	7
Mandan “	7	4
Minitari “	7	2
Crow “	12	5
Creek (Muskhogean)............	22	13
Choctaw “	8	1
Chickasaw “	12	8
Pawnee (Caddoan)...............	6	6
Shoshoni (Shoshonean)...........	6	6
Tlinkit (Koluschan)...............	10	10
Hopi (mixed stock)..............	87 (+)	48
Pueblo[3] (several stocks)..........	84	34

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[1] See Matthews, *Navaho Legends* (*Memoirs Am. Folk-lore Society*, 1897, p. 31); and *Journal of American Folk-lore*, vol. III, 1890, pp. 89–110.

[2] Bourke in *Journal of American Folk-lore*, vol. III, 1890, pp. 111–126.

[3] The Pueblo stocks included are the Tanoan, Keresan, and Zuñian. See Hodge, *Pueblo Indian Clans* (*American Anthropologist*, vol. IX, 1896, pp. 345–352), and Bourke, *Snake Dance of the Moquis of Arizona*, New York, 1884.